

ADVANCED SUBSIDIARY (AS) General Certificate of Education 2019

Mathematics

Assessment Unit AS 1 assessing Pure Mathematics

Centre Number

Candidate Number

SMT11

[SMT11] WEDNESDAY 15 MAY, MORNING

TIME

1 hour 45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer all nine questions in the spaces provided.

Do not write outside the boxed area on each page or on blank pages.

Complete in black ink only. Do not write with a gel pen.

Questions which require drawing or sketching should be completed using an H.B. pencil. All working should be clearly shown in the spaces provided. Marks may be awarded for partially correct solutions. **Answers without working may not gain full credit**. Answers should be given to three significant figures unless otherwise stated.

You are permitted to use a graphic or scientific calculator in this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

A copy of the Mathematical Formulae and Tables booklet is provided.

Throughout the paper the logarithmic notation used is $\ln z$ where it is noted that $\ln z \equiv \log_e z$ 11884

28SMT1101

28SMT1102

x + 2y + 3z = 9 2x - y + 4z = 17 3x + y - z = 2	
	•••••
	•••••
	•••••
	•••••
	•••••
	•••••
	••••
	•••••
	•••••
	•••••
	• • • • • •
	•••••

	••••••
	•••••
	•••••
	••••••
	•••••
	••••••
	••••••
•••••••••••••••••••••••••••••••••••••••	•••••
	••••••
	•••••
	·····
	••••••
	•••••
	•••••
	••••••
	•••••
	••••••
	••••••
•••••••••••••••••••••••••••••••••••••••	•••••
l	Turn over

28SMT1103

$\overrightarrow{OA} = 4\mathbf{i} - \mathbf{j}$
$\overrightarrow{OB} = 6\mathbf{i} + 2\mathbf{j}$
Find:
\rightarrow
(i) the magnitude of the vector AB, [3]



20 7 Learning
G:
2 Loaming
G
Reserving
Œ
Construction Description Theorem
7 Learning
œ
Learning
Reaserting The among
Ð
7 Learning
a
Rewarding
20
y Learning
œ
Reservin
7 Learning Rowarding
Rowardin
D
7 Learning
Rewarding
CC Rowardin DD y Learning
Leaning
Rewarding
20 Learning
2 Learning
Ce
7 Learning
Ð
7 Learning
Reserver
D
(Calina
Resarding
CC. Research CC.
Research
20 7 L 400 milety
7 Learning
Reverdin
Rowerter Rowerter
I Learning
Reserved
D
7 Learning
Rewardin
Romantin Romantin Do
T Learning Research
Reverting
D
Rewardle
2 Loaming
(Contraction)
Reserved
20 J Lavarritury
a committed

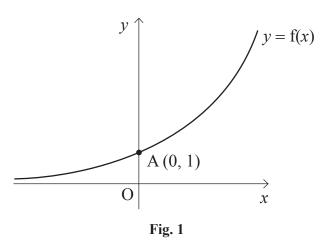
C.

28SMT1104

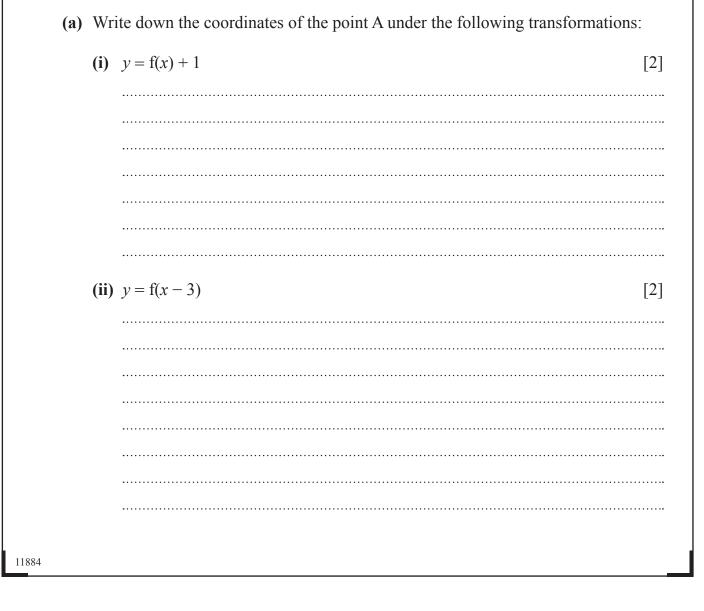
28SMT1105

•••••	 	 	
•••••	 	 	
••••••	 	 	
••••••	 	 	
••••••	 	 	
•••••	 	 	
••••••	 	 	
•••••	 	 	
••••••	 	 	
••••••	 	 	
•••••	 	 	

2 Fig. 1 below shows a sketch of the graph of the curve given by the equation y = f(x).

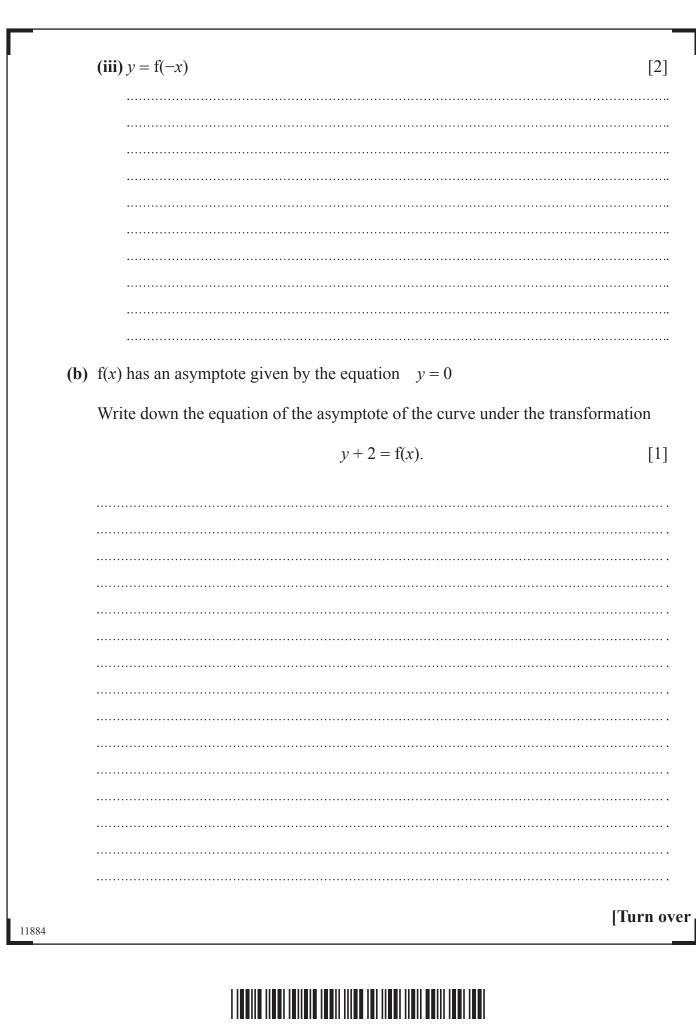


Point A has coordinates (0, 1).



28SMT1106

20 7 Learning a CC. D CC. Ð a D a Ð Ca. D a 20 J Learning CC. D CC. DD 7 Learning 200 T Learning CC. CC. Research CC. a



28SMT1107

Ð

20 7 Learning
G
CC Researchy DD 7 Louminy
7 Learning
a
(d:
Rewarding
Romarter Romarter Dog
20
2 Learning
a
CC Reserved D T Levening
7 Learning
a
7 Learning
Rowerdin
a
Learning
7 Learning Rowarding
Revertin
2D
œ
Newarding
CC Rowardin DD y Lowerigy
Rewarding
y Learning
Q
Reasered by Pleasanting
G
7 Learning
Rewardley
7 Learning
Reserting
CC. Towards Co.
a
Rewardin
Rowards Powards D
Rowards Rowards D
20
7 Learning
Rewards
Ð
Romartin Romartin Do
Reserting
7 Learning
Resarch
D
Rewarding
Reservice
2Desembry
CC: Passarday
7 Learning CCC Rowarding
a

3 (a) (i) Given that $\log_2 a = 3$ state the value of <i>a</i> .	[1]
		•••••
		•••••
(i	i) Hence solve the equation	
	$\log_2 x - \log_2 \left(x - 1 \right) = 3$	[5]
		•••••
		•••••
		•••••
		•••••
		,
		•••••
11884		

28SMT1108

	$3e^{2x} - 4 = 0$	[4]
••••••		
••••••		
••••••		
••••••		
••••••		
•••••••		
••••••		
••••••		
		[Turn o

28SMT1109

28SMT1110

	$x^2 + kx + 16 = 0$
has	s no real roots.
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	
•••••	

	$x^2 - 4x + y^2 + 6y - 3 = 0$	[6]
••••••		
		,
••••••		
		[Turn o

28SMT1111

11884	
-------	--

$\int_{1}^{k} 2\sqrt{x} \mathrm{d}x = \frac{28}{3}$	
find the value of k .	[6
••••••	



20 J Learning
a
~
a
0
a
Rewardin
a
Ð
Ø
I Learning CCC Researching
Ð
Ø
a
-
X:
a
Reserving
20
Learning
T Learning
a
Towardin
Ð
Revertin
a
Z
Learning
Rewardin
Reserved
3
20 Learning
y Loaming
A
Resourcing
30
Ð
Car Romanda D
Car Romanda D
Car Romanda D

28SMT1112

(b) Solve the equation

 $2\cos^2\theta = 1 - \sin\theta$

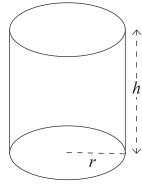
101 0 <	$\theta \leq 360^{\circ}$			[7]
		 		•••••••••••••••••••••••••••••••••••••••
		 		•••••••
		 		•••••••••••••••••••••••••••••••••••••••
		 		••••••
		 		••••••
		 		•••••••••••••••••••••••••••••••••••••••
•••••		 	••••••	•••••••••••••••••••••••••••••••••••••••
		 		•••••••
•••••		 		••••••
		 		••••••
		 		[Turn ove

28SMT1113

y Learning CC Reserved 20 J Loaming CC. CC. C. 20 J Learning C. 200 Rewards CC. 20 7 Learning CC. CC. De lasanta Revertin 200 CC. 200 CC. 200 T Levening CC. 20 7 Learning CC. 20 J Learning CC. CC. 20 7 Learning CC. 20 J Learning C. CC. 2 Leaning Resources 7 Leaning C.

[4]

6	An open tin	in the shape	of a cylinder	is shown in	Fig. 2 below.





The open tin has base radius $r \,\mathrm{cm}$ and height $h \,\mathrm{cm}$. The total surface area of the tin is $300 \,\pi \,\mathrm{cm}^2$

(i) Express h in terms of r .	
-----------------------------------	--

	••••••
	••••••
	••••••
	••••••

11884

28SMT1114

	$V = 150 \pi r - \frac{\pi r^3}{2}$	[3
••••••		
••••••		
••••••		,
••••••		
		[Turn

28SMT1115

*2	285	МΊ	1	116	*

(i	ii) Using calculus, find the values of r and h for which the volume of the tin is
	a maximum.

The volume of the tin is

[Turn over

28SMT1117

$2x^3 - 8x^2 + 3x + 10 = 0$	[
 	••••••

11884

|--|

28SMT1119

[Turn over

28SMT1120

(i)	A straight line, perpendicular to AB and passing through the point A, cuts the <i>x</i> -axis at the point P.			
	Find, in terms of <i>a</i> , the coordinates of the point P.	[8]		

28SMT1121

•	
•	
•	
•	
•	
•	
•	
•	
•	
•	
•	
•	
•	
•	
•	
•	
•	
•	
•	
•	
•	
•	
•	
•	
•	
•	

F	ind the possible values of <i>a</i> in their simplest surd form.
•••	
•••	
•••	
•••	
•••	
•••	
•••	
•••	
••	
•••	
•••	
••	
•••	
•••	
••	
•••	
••	
•••	
•••	
•••	
•••	
•••	
•••	
•••	
•••	
•••	
•••	
•••	



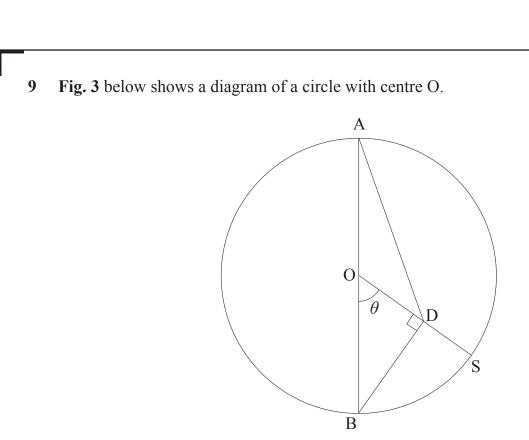
C.

28SMT1122

11004	[Turn ov	'er
11884		

20 7 Learning a 20 y Loaming CC. Ð a Ð a Ð a Ð Ca. Ð a Ð C. Ð a 20 7 Learning a D Ca. Ð C. Ð a Ð a Ð a 200 CC. 20 CC. 20 Learning CC. CC. 20 7 Learning Reserved Rowards DO 2 Loaming

a





AB is a diameter of the circle. S lies on the circumference of the circle. D is the foot of the perpendicular from B to OS.

The acute angle BOS is
$$\theta$$

OA = OB = rOD = x

(i) By applying the cosine rule to triangle AOD, show that

$$AD^{2} = r^{2} (1 + 3\cos^{2}\theta)$$
 [7]

11884

28SMT1124

	·
[Turn over	
	[Turn over

28SMT1126

Find t	he value of <i>k</i>	, where k	is a pos	itive int	eger.	
••••••						
•••••						
•••••						
•••••						
•••••					•••••	
•••••						
•••••						
•••••						
•••••						
•••••						
•••••						
•••••						
•••••						
•••••						
•••••						
•••••						
•••••						
•••••						
•••••						
•••••						
•••••						
•••••				• • • • • • • • • • • • • • • • • • • •		
•••••						
•••••					•••••	
•••••						
•••••						
•••••						

(ii) When BD bisects OS,

THIS IS THE END OF THE QUESTION PAPER



28SMT1127

DO NOT WRITE ON THIS PAGE

For Examiner's use only				
Question Number	Marks			
1				
2				
3				
4				
5				
6				
7				
8				
9				
Total Marks				
Marks				

Examiner Number

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright holders may have been unsuccessful and CCEA will be happy to rectify any omissions of acknowledgement in future if notified.

11884/4

28SMT1128